



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent No. : 7,130,052
Appl. No. : 10/808,010
Issue Date : October 31, 2006
Inventor : Daniel James Kane
Title : Real Time Measurement of Ultrashort Laser Pulses

Commissioner for Patents
Office of Patent Publication
P.O. Box 1450
Alexandria, VA 22313-1450

Certificate

JAN 05 2011

of Correction

Attn: Certificate of Correction Branch

REQUEST FOR EXPEDITED ISSUANCE OF CERTIFICATE OF CORRECTION

Sir:

This is a request for expedited issuance of certificate of correction pursuant to 37 CFR 1.322. The inventor and sole assignee requests that the Patent Office issue a certificate of correction to correct three errors in the claims of U.S. Patent No. 7,130,052, as detailed below. Each of these errors is believed to be a Patent Office error and is evident from the attached documentation. Form PTO/SB/44 listing these errors is enclosed.

There was an error in printing claim 12 of U.S. Patent No. 7,130,052. Specifically, in claim 12, column 15 at line 48, the word "displaces" should be replaced with the word "displays". This is a Patent Office error. Attached is illustration of that error. Issued claim 12 corresponds to application claim 10. On page 4 of 15, the amendment version of claim 10 (issued claim 12) includes the word "displays" which

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Inventor : Daniel James Kane

was erroneously printed as "displaces" in the issued patent at claim 12, column 15, line 48. Exhibit 1 is a copy of an Amendment filed on April 7, 2006. Exhibit 2 is a copy of the Notice of Allowability that indicates that the Notice of Allowability was responsive to an Amendment received on April 11, 2006 and so indicates the Exhibit 1 text of application claim 10 (issued claim 12) was adopted by the Examiner and allowed in that form.

Errors were introduced into issued claims 10 and 12 through an Examiner's amendment accompanying the Notice of Allowability. Attached within Exhibit 2 is a copy of the Examiner's amendment. The Examiner's amendment added the language "providing the feedback parameter to a user or to a FROG process" to claim 1 and added application claim 22, which depends from claim 1 and became patent claim 10. The Examiner's amendment added application claim 22 using the language "feedback parameter is provided to the use" Application claim 22 should have used the word "user" instead of "use" in this phrase to have proper antecedence and to be consistent with the other Examiner's amendments. This error was propagated into issued patent claim 10 at column 15, line 36. This is a Patent Office error and can properly be corrected by this request.

The Examiner's amendment also added the language "providing the feedback parameter to a use or to a FROG process" to application claim 10, which is an independent claim and became patent claim 12. The Examiner's amendment added application claim 10 using the language "feedback parameter to the use" Application claim 10 should have used the word "user" instead of "use" in this phrase. This would provide consistency with the other Examiner's amendments and would then provide proper antecedence for the language "feedback parameter is provided to the

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Inventor : Daniel James Kane

user ..." in application claim 24 (patent claim 15). This error was propagated into issued patent claim 12. This is a Patent Office error and can properly be corrected by this request.

In light of this demonstration of Patent Office error, the undersigned requests expedited issuance of a certificate of correction. Attached is a copy of a completed Form PTO/SB/44. Because this is a request for correction under 37 CFR 1.322 for correction of Patent Office errors, the undersigned believes no fee is required.

If the Patent Office believes that a telephone conversation can further expedite this request for certificate of correction, or if the Patent Office believes that a fee is due in connection with this Request for Expedited Issuance of Certificate of Correction, please call Daniel J. Kane at (505) 216-5015.

Respectfully submitted,

Dated: 12/30/10

By: Daniel J. Kane
Daniel J. Kane



UNITED STATES PATENT AND TRADEMARK OFFICE CERTIFICATE OF CORRECTION

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APPLICATION NO.: 10/808,010
ISSUE DATE : October 31, 2006
INVENTOR(S) : Daniel James Kane

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

- In claim 10, at column 15, line 36, delete "use" and replace with --user--.
- In claim 12, at column 15, line 48, delete "displaces" and replace with --displays--.
- In claim 12, at column 15, line 52, delete "use" and replace with --user--.

MAILING ADDRESS OF SENDER (Please do not use customer number below):

Daniel J. Kane, 174 Galisteo Lane, Santa Fe, NM 87505

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



3/1

Notice of Allowability

Application No.

10/808,010

Examiner

Michael A. Lyons

Applicant(s)

KANE, DANIEL JAMES

Art Unit

2877

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to amendment filed 11 April 2006.
2. ☒ The allowed claim(s) is/are 1-25.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____

EXAMINER'S AMENDMENT AND STATEMENT OF REASONS FOR ALLOWANCE

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Daniel Kane on August 15, 2006.

The application has been amended as follows:

Claims 1 and 10 are amended as follows, while claims 22-25 are newly added.

1. A method for real-time measurement of ultrashort laser pulses comprising:

recording in a computer measured frequency resolved optical gating (FROG) trace data generated by processing a pulse in a FROG device;

processing the measured FROG trace to perform real time phase retrieval and generating in real time a retrieved pulse from the measured FROG trace;

displaying the retrieved pulse; [and]

generating in real time a feedback parameter providing information characterizing the real time phase retrieval[.]; and

providing the feedback parameter to a user or to a FROG process.

10. A method of performing real time phase retrieval processing of frequency resolved optical gating (FROG) traces, the method comprising:

receiving as input a measured FROG trace data set, the FROG trace data set generated by processing a pulse in a FROG device;

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processing the measured FROG trace data set to perform real time phase retrieval and generating in real time a retrieved pulse from the measured FROG trace;

generating displaces of the retrieved pulse at a rate of 3 Hz or faster; [and]

generating a feedback parameter providing information characterizing the real time phase retrieval[.]; and

providing the feedback parameter to a use or a FROG retrieval.

22. The method of claim 1 where the feedback parameter is provided to the use and to a FROG process.

23. The method of claim 1 where the feedback parameter is provided to the user through a display.

24. The method of claim 10 where the feedback parameter is provided to the user and to a FROG retrieval.

25. The method of claim 10 where the feedback parameter is provided to the user through a display.

Allowable Subject Matter

Claims 1-25 are allowed in view of the prior art.

The following is an examiner's statement of reasons for allowance:

As to claim 1, the prior art of record, taken either alone or in combination, fails to disclose or render obvious a method for real-time measurement of ultrashort laser pulses, the method comprising recording frequency resolved optical gating (FROG) trace data that is generated by processing a pulse in a FROG device, processing the trace to perform real time phase retrieval and generating in real time a retrieved pulse from the trace, displaying the pulse,

and generating a feedback parameter in real time that provides information characterizing the real time retrieval, in combination with the rest of the limitations of the above claim.

As to claim 10, the prior art of record, taken either alone or in combination, fails to disclose or render obvious a method of performing real time phase retrieval processing of FROG traces, the method comprising receiving as an input a measured FROG trace data set that is generated by processing a pulse in a FROG device, processing the data set to perform real time phase retrieval and generating in real time a retrieved pulse from the trace, generating displays of the pulse at rates of 3 Hz or faster, and generating a feedback parameter that provides information characterizing the real time phase retrieval, in combination with the rest of the limitations of the above claim.

As to claim 13, the prior art of record, taken either alone or in combination, fails to disclose or render obvious a method of performing real time phase retrieval processing of FROG traces, the method comprising receiving as an input a measured FROG trace data set that is generated by processing a pulse in a FROG device, processing the data set to perform real time phase retrieval and generating in real time a retrieved pulse from the trace, generating a display of the pulse in real time, and generating a feedback parameter that provides information characterizing the real time phase retrieval and using the feedback parameter to perform a control operation, in combination with the rest of the limitations of the above claim.

In particular with regards to the above claims, please see the applicant's arguments dated April 11, 2006 in response to the previous Office Action of record that lay out detailed reasons as to the allowability of the claims in view of the prior art.

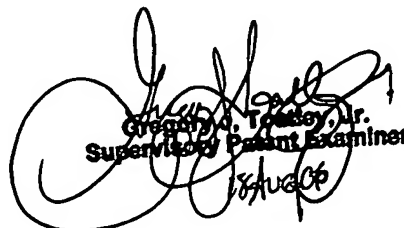
Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael A. Lyons whose telephone number is 571-272-2420. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory J. Toatley can be reached on 571-272-2800 ext. 77. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MAL
August 16, 2006


Gregory J. Toatley, Jr.
Supervisor Patent Examiner
18 Aug 06

Appl. No. 10/808,010
Reply to Office Action of February 21, 2006



THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Kane, Daniel James

Serial No: 10/808,010

Filed: March 24, 2004

For: **REAL-TIME MEASUREMENT OF
ULTRASHORT LASER PULSES**

Art Unit: 2877

Examiner: Michael A. Lyons

AMENDMENT

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

I hereby certify that this correspondence
is being deposited with the United States
Postal Service with sufficient postage as
first class mail in an envelope addressed
to: Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

4/7/2006

Date of Deposit

Daniel James Kane

Name

Signature

Daniel James Kane

Date

4/7/06

Dear Sir:

This is in response to the Office Action dated February 21, 2006. Please
amend the above-referenced application as follows:

Amendments to the claims are reflected in the listing that begins on page 2
of this paper.

Amendments to the Drawings begin on page 7 of this paper and include
both an attached replacement sheet and an annotated sheet showing changes.

Remarks begin on page 8 of this paper.

An **Appendix** including amended drawing figures is attached following page
15 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Original) A method for real-time measurement of ultrashort laser pulses comprising:

recording in a computer measured frequency resolved optical gating (FROG) trace data, the FROG trace data generated by processing a pulse in a FROG device;

processing the measured FROG trace to perform real time phase retrieval and generating in real time a retrieved pulse from the measured FROG trace;

displaying the retrieved pulse; and

generating in real time a feedback parameter providing information characterizing the real time phase retrieval.

2. (Original) The method of claim 1 where the feedback parameter is the FROG trace error.

3. (Original) The method of claim 1 where the feedback parameter is a display of the measured and retrieved FROG traces.

4. (Original) The method of claim 1, where the real time phase retrieval uses a previous result as a starting point for a subsequent retrieval.

5. (Original) The method of claim 1, further comprising determining a background correction factor providing a minimum FROG trace error.
6. (Original) The method of claim 1, further comprising:
recording a signal pulse with a camera, the signal pulse generated within the FROG device from the pulse, the camera performing gamma correction;
producing the measured FROG trace from output of the camera; and
preprocessing the measured FROG trace to reverse the gamma correction implemented during measurement of the measured FROG trace.
7. (Original) The method of claim 1, further comprising filtering the measured FROG trace to reduce a magnitude of artifacts in the measured FROG trace prior to the real time phase retrieval processing.
8. (Original) The method of claim 1, further comprising analog processing of a spectrogram corresponding to the pulse, the analog processing prior to generating the retrieved pulse.
9. (Original) The method of claim 1, wherein the real time phase retrieval comprises principal component generalized projections processing.
10. (Original) A method of performing real time phase retrieval processing of frequency resolved optical gating (FROG) traces, the method comprising:

receiving as input a measured FROG trace data set, the FROG trace data set generated by processing a pulse in a FROG device;

processing the measured FROG trace data set to perform real time phase retrieval and generating in real time a retrieved pulse from the measured FROG trace;

generating displays of the retrieved pulse at a rate of 3 Hz or faster; and

generating a feedback parameter providing information characterizing the real time phase retrieval.

11. (Original) The method of claim 10, wherein the method is embodied in a computer program product.

12. (Original) The method of claim 11, further comprising selectively preprocessing the measured FROG trace data set to apply a reverse gamma correction to the measured FROG trace data set.

13. (Original) A method of performing real time phase retrieval processing of frequency resolved optical gating (FROG) traces, the method comprising:

receiving as input a measured FROG trace data set, the FROG trace data set generated by processing a pulse in a FROG device;

processing the measured FROG trace data set to perform real time phase retrieval and generating in real time a retrieved pulse from the measured FROG trace;

generating in real time a display of the retrieved pulse; and

generating in real time a feedback parameter providing information characterizing the real time phase retrieval; and

performing a control operation in response to the feedback parameter.

14. (Original) The method of claim 13, wherein the control operation comprises restarting the phase retrieval process.

15. (Original) The method of claim 14, wherein the restarting the phase retrieval process takes as an input a Gaussian pulse having random phase.

16. (Currently amended) The method of claim ~~[[14]]~~ 13 where the feedback parameter is the FROG trace error.

17. (Original) The method of claim 13 where the feedback parameter is a simultaneous real time display of the measured and retrieved FROG traces.

18. (Original) The method of claim 13, further comprising selectively filtering the measured FROG trace data set prior to the real time phase retrieval processing, the selectively filtering responsive to user inputs.

19. (Original) The method of claim 13, further comprising selectively analog processing a spectrogram corresponding to the pulse, the selectively analog processing prior to generating the retrieved pulse.

20. (Original) The method of claim 13, further comprising selectively preprocessing the measured FROG trace data set to apply a reverse gamma correction to the measured FROG trace data set.

21. (Original) The method of claim 13, wherein the measured FROG trace data set is received from a frame grabber.

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Amendments to the Drawings:

The attached sheet of drawings includes changes to Figures 1-3. These sheets, which includes Figures 1-7 replaces the original sheets including Figures 1-7. In Figures 1-3, previously omitted "Prior Art" has been added.

Attachment: Replacement Sheet
Annotated Sheet Showing Changes

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Reply to Office Action of February 21, 2006

REMARKS:

This is in response to the Office Action dated February 21, 2006. Claim 16 has been amended to broaden the claim. Reexamination and reconsideration are respectfully requested.

The Drawings:

The Office Action objects to the drawings. Applicant proposes drawing corrections indicated in red on the attached sheets and provides replacement formal drawings incorporating the changes.

The § 112 Rejection:

The Office Action rejects the pending claims as indefinite for "omitting essential steps." Applicant respectfully submits that the claims are definite and their scope is readily understood by one of ordinary skill.

Applicant further submits that the claims are complete as written and do not omit "essential steps." As discussed in the background of the application at paragraph 28, the real time FROG implementation using PCPG phase retrieval generally converges well. The application indicates at paragraph 42 that the PCPG phase retrieval technique (as an example) can stagnate or otherwise develop errors. "Consequently, it is preferable to ... provide[] feedback to a user to allow identification of stagnation or other types of errors." The particular feedback provided in the inventions of claims 1 and 10 is a feedback parameter.

Because the FROG technique generally converges well, it is generally unnecessary to do anything in response to or with the feedback parameter. Action is required on the feedback parameter only if the feedback parameter shows that there are problems with the retrieval. The claims apply to individual measurements or phase retrievals and so most individual measurements or phase retrievals practicing the claims need not do anything with the feedback parameter once it is obtained. Thus, it is not "essential" to the invention of claims 1 or 10 that anything be done with the feedback parameter.

There is nothing in the application that suggests that the additional steps proposed in the Office Action's § 112 rejection are "essential" to implementations of the invention of claims 1 and 10. To the contrary, it is clear from the application that, on most measurements or phase retrieval operations according to the inventions of claims 1 and 10, nothing needs to be done with the feedback parameter because the methods will converge without errors or stagnation. Thus, practice of the inventions of claims 1 and 10 may generate but not use the feedback parameter.

It appears that the Office Action views the use of the word "feedback" in the claims and application to imply a control system. That is not intended nor does the application indicate that a control system is required to implement its teachings. Rather, the various implementations described in the application make it clear that,

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while a control system implementation is possible, it is by no means the only way to implement aspects of the application's teachings. Similarly, while claims 1 and 10 can be implemented to normally perform a function in response to the feedback parameter, that is by no means required.

The Office Action also rejects claim 13 and its dependent claims, despite the explicit recitation that the feedback parameter is used to perform a control operation. The application describes various control operations that might be implemented using the feedback parameter. Applicant submits that there are no missing "essential steps" in the definition of the claim 13 invention. Rather, claim 13 corresponds to a number of different control operations, various examples of which are set out in the application.

Applicant notes that some of the control operations within the scope of claim 13 are specifically called out in claim 13's dependent claims. Applicant submits that the Office Action's § 112 rejection is wholly misplaced with respect to claims 14-21.

Applicant respectfully requests reconsideration and withdrawal of the indefiniteness rejection.

The § 103 Rejections:

The Office Action rejects claims 1-5, 8-11, 13-14, 16-17, 19 and 21 over an article by Kane, et al., "Real-time Inversion of Polarization Gate Frequency-Resolved Optical Gating Spectrograms, Applied Optics, Vol. 42, No. 6, 1140-44 (Feb.

2003) taken in view of U.S. Patent No. 6,570,704 to Palese. The remaining claims are rejected over the Kane article taken in view of the Palese patent and further taken in view of one or more additional references. Applicant submits that, if the teachings of the Kane article were combined with the teachings of the Palese patent, the result of the combination would not be the methods defined by any of the pending claims.

Specifically, the Palese patent teaches using the *output* from a FROG retrieval to provide feedback for phase and wavelength locking of the multiple sources of a laser array. See Palese patent at col. 6, lines 4-14. FROG retrieval itself provides the feedback in the system – there is no process that provides feedback about the quality of the FROG retrieval. If the FROG retrieval has an error or stagnation, neither the Palese patent nor the Kane article would detect such an error or stagnation. The Palese patent does not teach developing feedback that characterizes the quality of the FROG retrieval.

The Palese patent does not suggest modifying the FROG retrieval processes of the Kane article. Nothing in the Palese patent could be used in improving the general FROG retrieval process. For example, the FROG retrieval processes of the Kane article would not benefit from the phase or wavelength locking suggested by the Palese patent.

To be clear, the teachings of the Kane article can and would be readily implemented in the system described by the Palese patent, but that resulting system would not generate the feedback parameter recited in each of the independent claims of the present application. The Palese patent's system generates feedback about wavelengths and phase using FROG to determine the phase and wavelengths of an optical system used to recompress optical pulses that is external to and independent of the FROG device. Neither that sort of feedback nor optical system is used in the FROG retrieval process. If the teachings of the Kane article and the Palese article were combined, the combined system would provide feedback about wavelength and phase locking and would not provide any feedback about the quality of the FROG retrieval process.

The system resulting from modifying the Palese patent in view of the Kane article would never generate a "feedback parameter providing information characterizing the real time phase retrieval" obtained by "processing the measured FROG trace" as required by claim 1 and its dependent claims. The other references do not address the deficiencies of the Office Action's proposed combination. Consequently, claim 1 and claims 2-9 distinguish over the art of record and are in condition for allowance.

Claim 10 similarly distinguishes over the cited references by reciting "generating a feedback parameter providing information characterizing the real

time phase retrieval" obtained by "processing the measured FROG trace data set."
The combined teachings of the Kane article and the Palese patent would not generate a feedback parameter characterizing the real time phase retrieval obtained by FROG processing. Thus, claims 10, 11 and 12 distinguish over the art of record and are in condition for allowance.

Claim 13 distinguishes over the art of record by reciting "generating in real time a feedback parameter providing information characterizing the real time phase retrieval" obtained by "processing the measured FROG trace data set." Claim 13 and its dependent claims 14-21 distinguish over the Kane article taken in view of the Palese patent and are in condition for allowance.

Additional Comments:

Applicant wishes to correct certain erroneous comments about the Kane article in the discussion of the dependent claims. The FROG trace error has never been used on real-time FROG systems for real-time monitoring the retrieval because the PCGP algorithm does not use the FROG trace error or perform any minimization. The FROG trace error described in the Kane article was calculated on saved data obtained by a real-time FROG device.

With respect to claims 2, 3, 16 and 17, none of the referenced trace errors or display of trace errors is derived in real time in the Kane article. Figure 3 of the Kane article does not disclose a display of the measured and retrieved FROG traces.

It discloses a raw video display of the output from the FROG device, which is a display of the measured FROG trace (shown as an image and available as a 3-D plot), and it discloses a display of the retrieved pulse. The retrieved pulse is not the same as the retrieved FROG trace. The retrieved pulse is displayed on an X-Y plot while the retrieved FROG trace is calculated from the retrieved pulse and is displayed as an image or a 3-D plot. The retrieved FROG trace is a spectrogram of the retrieved pulse. Comparing the measured FROG trace with the retrieved FROG trace can be used to determine the fidelity of the FROG retrieval, which is even more effective than the real-time display of the FROG trace error.

With respect to the Office Action's comments about claim 4, claim 4 does not relate to a feedback loop. The feedback loop of the Palese patent does not relate to the Kane article's FROG phase retrieval process. Using the previous result as a starting point for a subsequent retrieval is not inherent for FROG retrievals. The FROG retrieval may work best when a pulse with random phase is used as the initial guess. Indeed, using smooth phase for a starting point can actually slow down the retrieval.

With respect to claims 6, 12 and 20, applicant disagrees with the Office Action's assumptions with respect to gamma correction. Gamma correction is common in video systems. It is not commonly used in scientific applications, however. The reason for gamma correction in some of the application's real-time

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FROG inversions is not obvious. Because FROG retrievals use the square root of image data, any noise present in the FROG trace is effectively amplified, sometimes severely, which can cause problems with the FROG retrieval. Thus, turning the gamma correction on can help to suppress noise in the FROG retrievals.

Claim 14 teaches the use of a control operation to restart the phase retrieval process and does not discuss the use of a previous result as a starting point for a subsequent retrieval. Applicant consequently submits that the Office Action's analysis of claim 14 is incorrect.

Respectfully submitted,

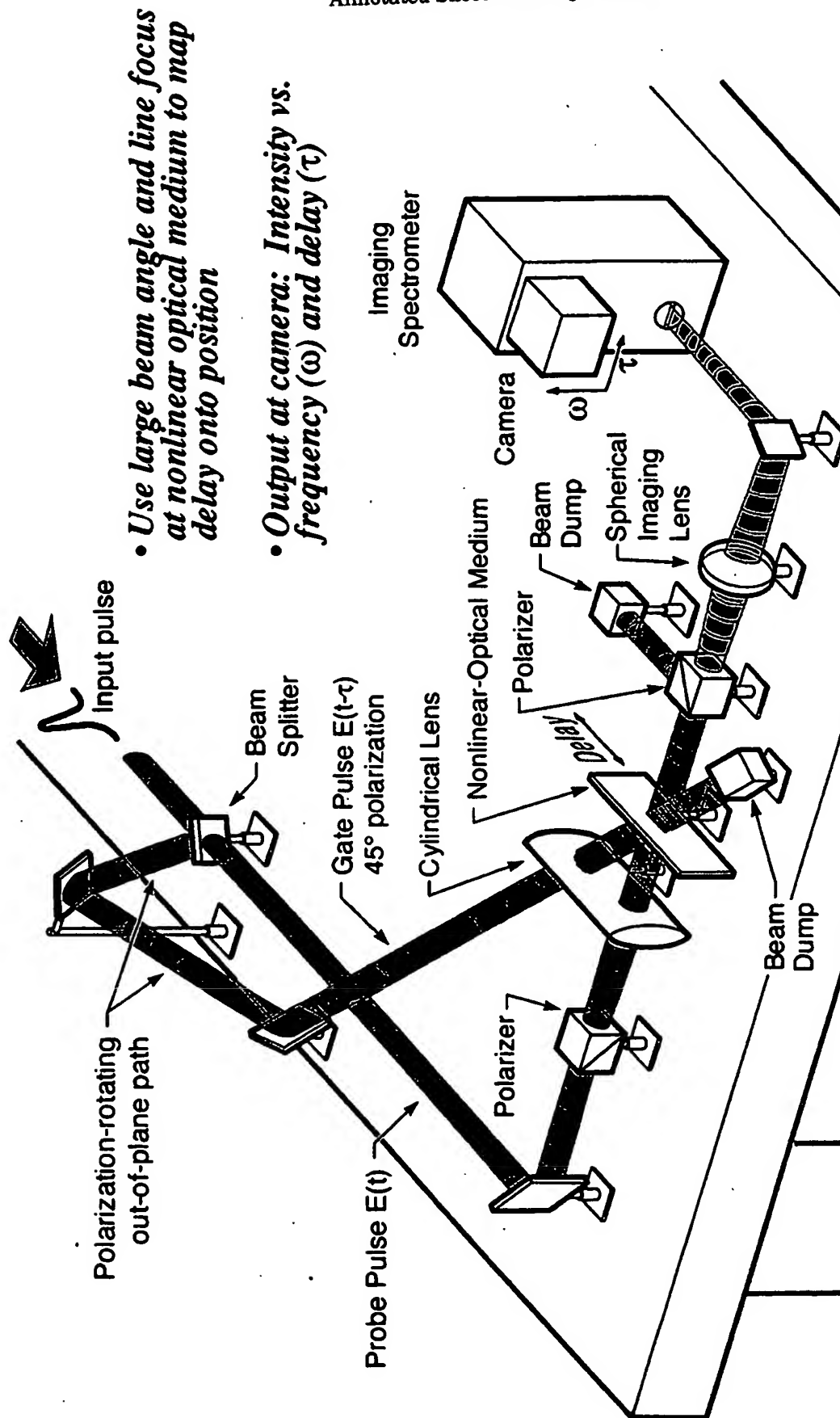
Date: 4/7/2006

By: Daniel J. Kane
Daniel J. Kane

174 Galisteo Lane
Sante Fe, NM 87505

Single-shot Polarization-Gate FROG

Appl. No. 10/808,010
 Reply to Office Action of 02/21/06
 Annotated Sheet Showing Changes



- Use large beam angle and line focus at nonlinear optical medium to map delay onto position
- Output at camera: Intensity vs. frequency (ω) and delay (τ)

PRIOR ART

FIG. 1

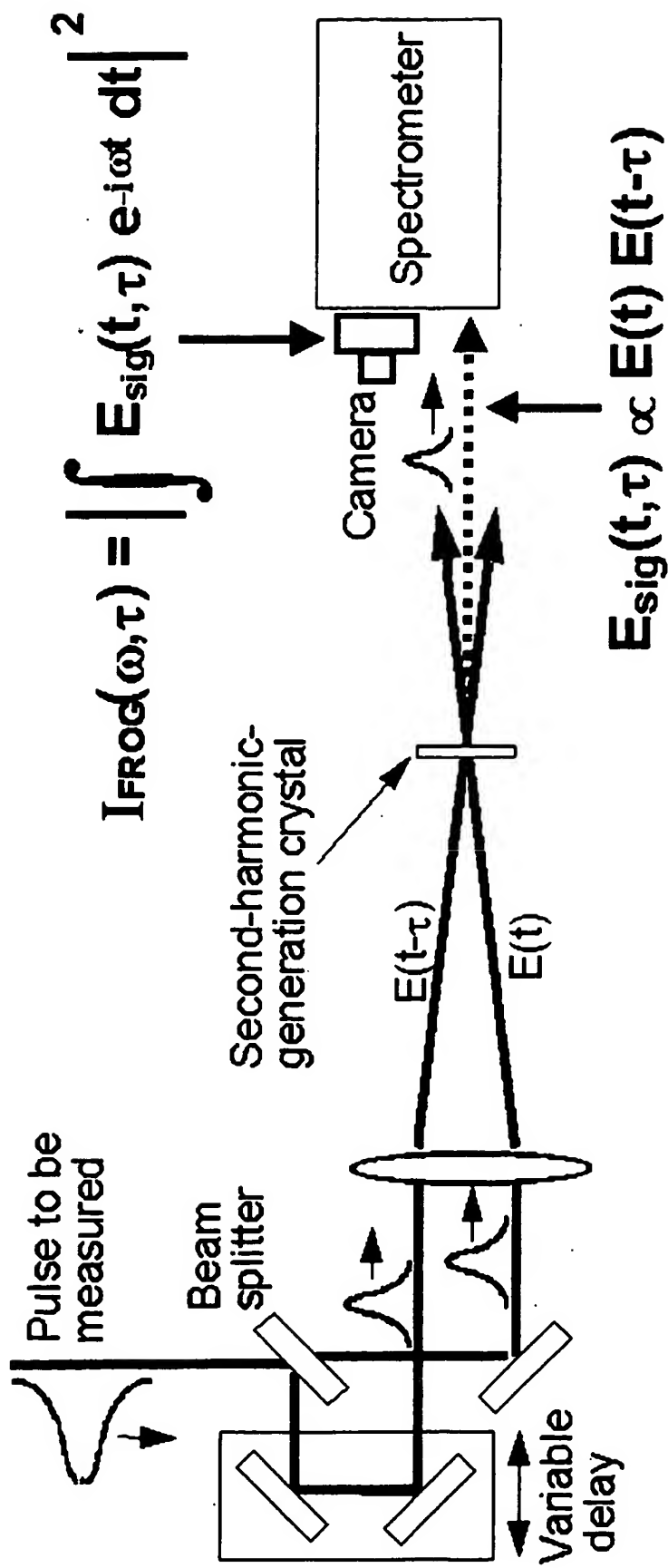


FIG. 2

PRIOR ART

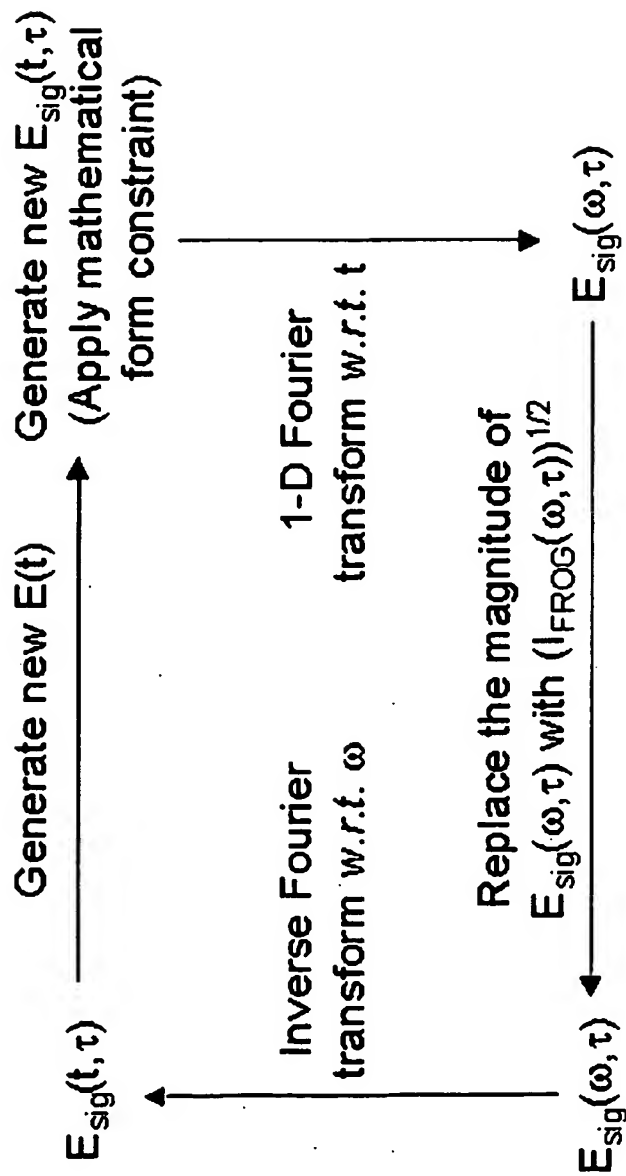


FIG. 3

PRIOR ART

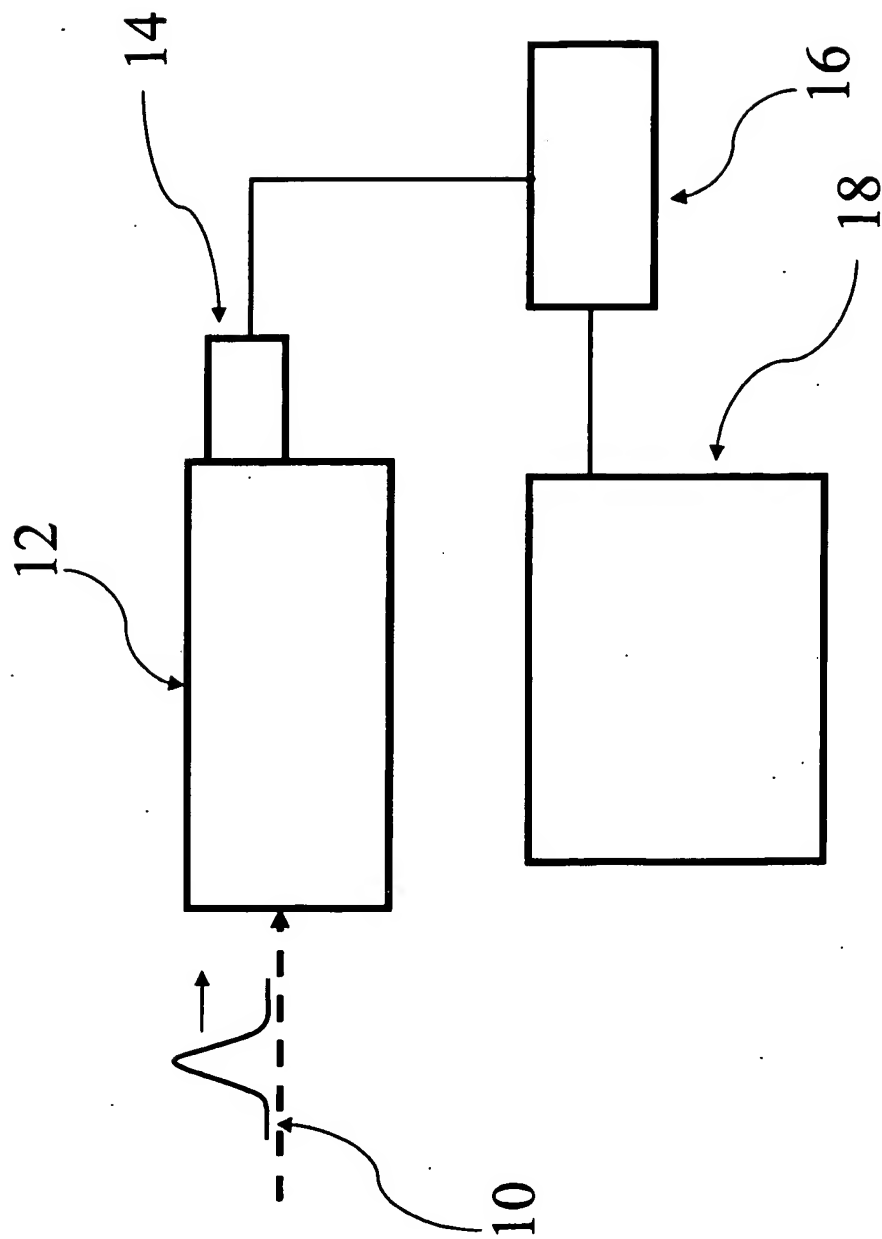


FIG. 4

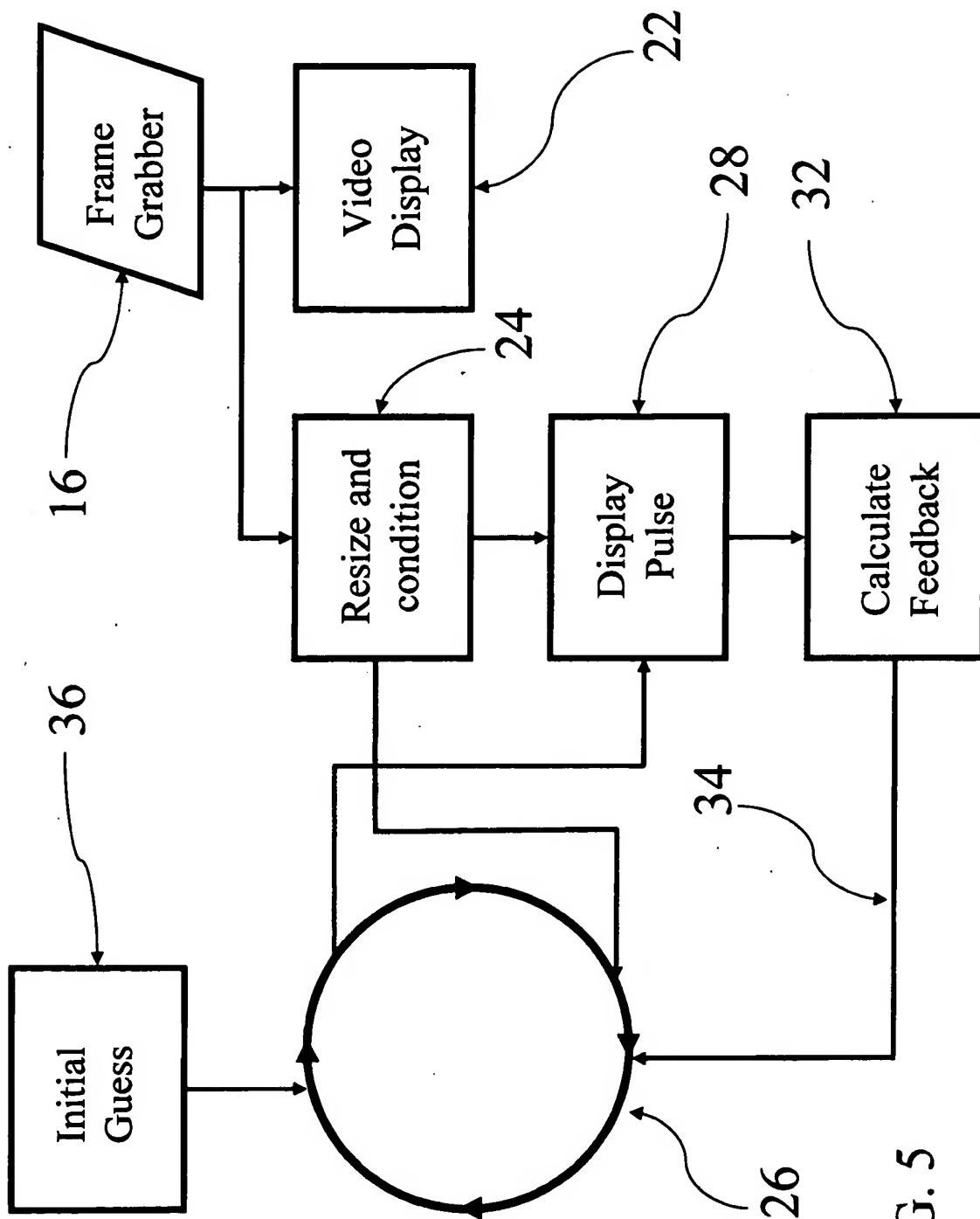


FIG. 5

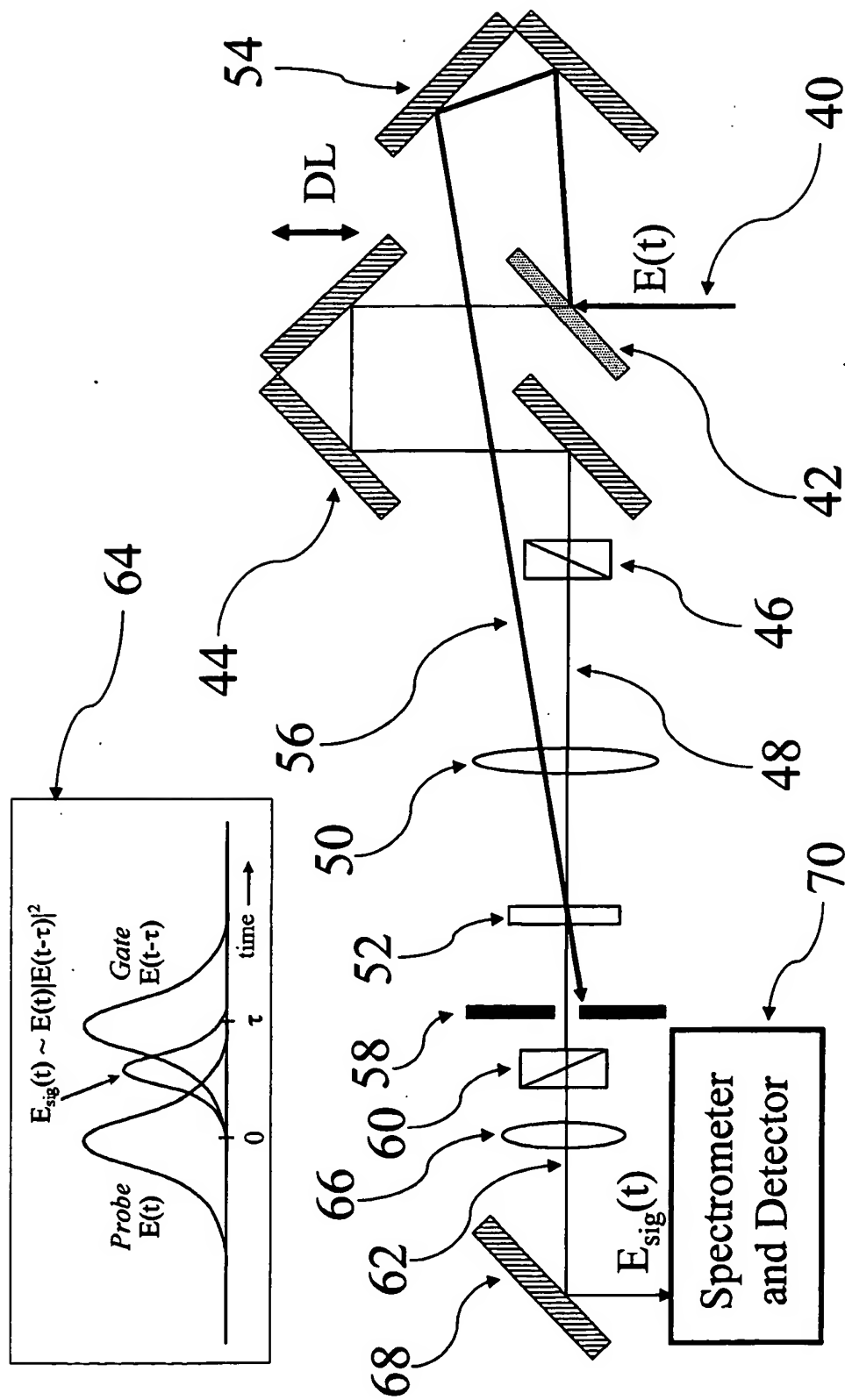


FIG. 6

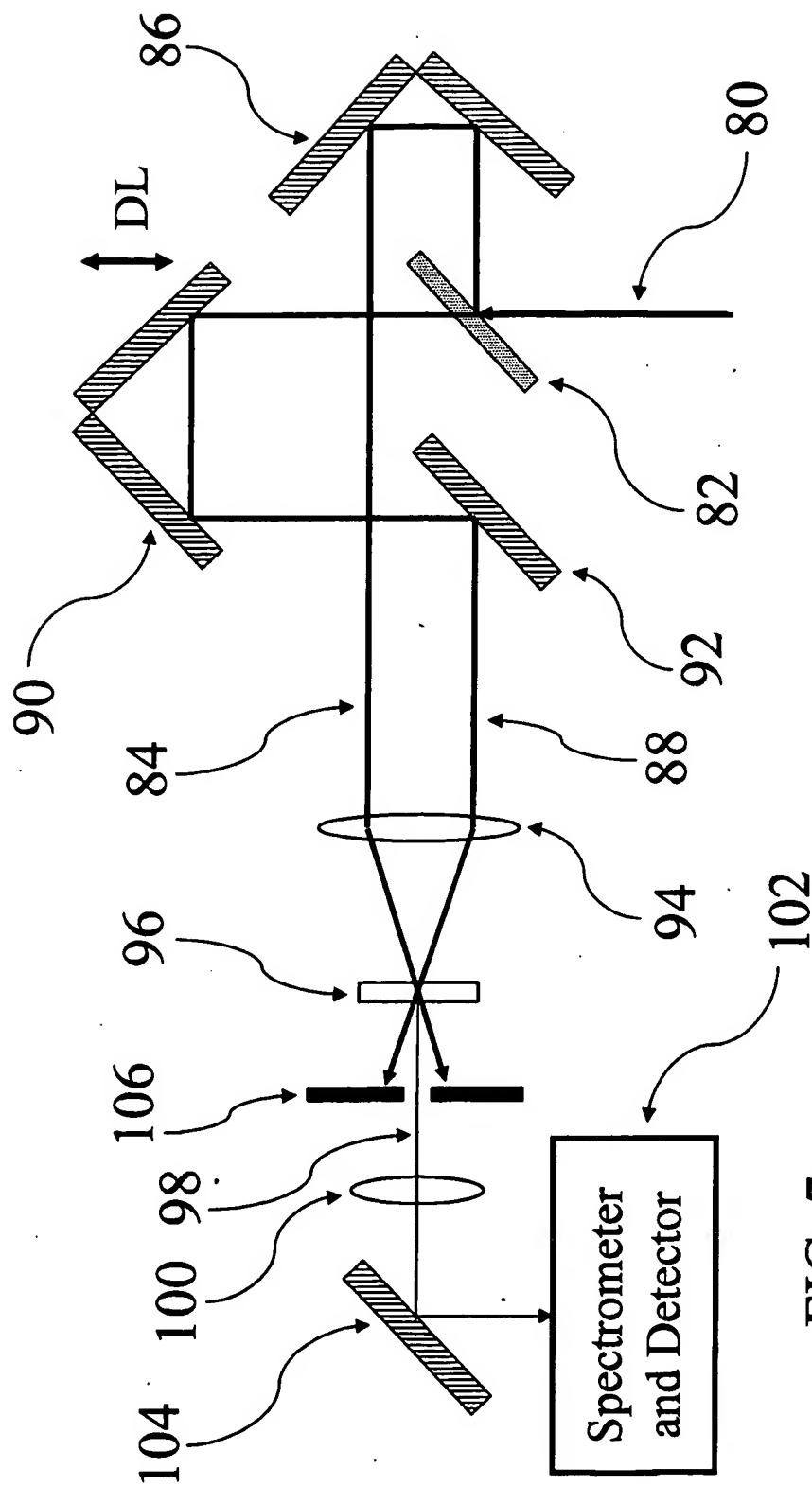


FIG. 7

Appl. No. 10/808,010
Reply to Office Action of February 21, 2006



THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Kane, Daniel James

Serial No: 10/808,010

Filed: March 24, 2004

For: **REAL-TIME MEASUREMENT OF
ULTRASHORT LASER PULSES**

Art Unit: 2877

Examiner: Michael A. Lyons

AMENDMENT

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

I hereby certify that this correspondence
is being deposited with the United States
Postal Service with sufficient postage as
first class mail in an envelope addressed
to: Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

4/7/2006

Date of Deposit

Daniel James Kane

Name

Signature

Daniel James Kane

Date

4/7/06

Dear Sir:

This is in response to the Office Action dated February 21, 2006. Please
amend the above-referenced application as follows:

Amendments to the claims are reflected in the listing that begins on page 2
of this paper.

Amendments to the Drawings begin on page 7 of this paper and include
both an attached replacement sheet and an annotated sheet showing changes.

Remarks begin on page 8 of this paper.

An **Appendix** including amended drawing figures is attached following page
15 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Original) A method for real-time measurement of ultrashort laser pulses comprising:

recording in a computer measured frequency resolved optical gating (FROG) trace data, the FROG trace data generated by processing a pulse in a FROG device;
processing the measured FROG trace to perform real time phase retrieval and generating in real time a retrieved pulse from the measured FROG trace;
displaying the retrieved pulse; and
generating in real time a feedback parameter providing information characterizing the real time phase retrieval.

2. (Original) The method of claim 1 where the feedback parameter is the FROG trace error.

3. (Original) The method of claim 1 where the feedback parameter is a display of the measured and retrieved FROG traces.

4. (Original) The method of claim 1, where the real time phase retrieval uses a previous result as a starting point for a subsequent retrieval.

5. (Original) The method of claim 1, further comprising determining a background correction factor providing a minimum FROG trace error.
6. (Original) The method of claim 1, further comprising:
recording a signal pulse with a camera, the signal pulse generated within the FROG device from the pulse, the camera performing gamma correction;
producing the measured FROG trace from output of the camera; and
preprocessing the measured FROG trace to reverse the gamma correction implemented during measurement of the measured FROG trace.
7. (Original) The method of claim 1, further comprising filtering the measured FROG trace to reduce a magnitude of artifacts in the measured FROG trace prior to the real time phase retrieval processing.
8. (Original) The method of claim 1, further comprising analog processing of a spectrogram corresponding to the pulse, the analog processing prior to generating the retrieved pulse.
9. (Original) The method of claim 1, wherein the real time phase retrieval comprises principal component generalized projections processing.
10. (Original) A method of performing real time phase retrieval processing of frequency resolved optical gating (FROG) traces, the method comprising:

receiving as input a measured FROG trace data set, the FROG trace data set generated by processing a pulse in a FROG device;

processing the measured FROG trace data set to perform real time phase retrieval and generating in real time a retrieved pulse from the measured FROG trace;

generating displays of the retrieved pulse at a rate of 3 Hz or faster; and
generating a feedback parameter providing information characterizing the real time phase retrieval.

11. (Original) The method of claim 10, wherein the method is embodied in a computer program product.

12. (Original) The method of claim 11, further comprising selectively preprocessing the measured FROG trace data set to apply a reverse gamma correction to the measured FROG trace data set.

13. (Original) A method of performing real time phase retrieval processing of frequency resolved optical gating (FROG) traces, the method comprising:

receiving as input a measured FROG trace data set, the FROG trace data set generated by processing a pulse in a FROG device;

processing the measured FROG trace data set to perform real time phase retrieval and generating in real time a retrieved pulse from the measured FROG trace;

generating in real time a display of the retrieved pulse; and

generating in real time a feedback parameter providing information characterizing the real time phase retrieval; and

performing a control operation in response to the feedback parameter.

14. (Original) The method of claim 13, wherein the control operation comprises restarting the phase retrieval process.

15. (Original) The method of claim 14, wherein the restarting the phase retrieval process takes as an input a Gaussian pulse having random phase.

16. (Currently amended) The method of claim ~~[[14]]~~ 13 where the feedback parameter is the FROG trace error.

17. (Original) The method of claim 13 where the feedback parameter is a simultaneous real time display of the measured and retrieved FROG traces.

18. (Original) The method of claim 13, further comprising selectively filtering the measured FROG trace data set prior to the real time phase retrieval processing, the selectively filtering responsive to user inputs.

19. (Original) The method of claim 13, further comprising selectively analog processing a spectrogram corresponding to the pulse, the selectively analog processing prior to generating the retrieved pulse.

20. (Original) The method of claim 13, further comprising selectively preprocessing the measured FROG trace data set to apply a reverse gamma correction to the measured FROG trace data set.

21. (Original) The method of claim 13, wherein the measured FROG trace data set is received from a frame grabber.

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Amendments to the Drawings:

The attached sheet of drawings includes changes to Figures 1-3. These sheets, which includes Figures 1-7 replaces the original sheets including Figures 1-7. In Figures 1-3, previously omitted "Prior Art" has been added.

Attachment: Replacement Sheet

Annotated Sheet Showing Changes

REMARKS:

This is in response to the Office Action dated February 21, 2006. Claim 16 has been amended to broaden the claim. Reexamination and reconsideration are respectfully requested.

The Drawings:

The Office Action objects to the drawings. Applicant proposes drawing corrections indicated in red on the attached sheets and provides replacement formal drawings incorporating the changes.

The § 112 Rejection:

The Office Action rejects the pending claims as indefinite for "omitting essential steps." Applicant respectfully submits that the claims are definite and their scope is readily understood by one of ordinary skill.

Applicant further submits that the claims are complete as written and do not omit "essential steps." As discussed in the background of the application at paragraph 28, the real time FROG implementation using PCPG phase retrieval generally converges well. The application indicates at paragraph 42 that the PCPG phase retrieval technique (as an example) can stagnate or otherwise develop errors. "Consequently, it is preferable to ... provide[] feedback to a user to allow identification of stagnation or other types of errors." The particular feedback provided in the inventions of claims 1 and 10 is a feedback parameter.

Because the FROG technique generally converges well, it is generally unnecessary to do anything in response to or with the feedback parameter. Action is required on the feedback parameter only if the feedback parameter shows that there are problems with the retrieval. The claims apply to individual measurements or phase retrievals and so most individual measurements or phase retrievals practicing the claims need not do anything with the feedback parameter once it is obtained. Thus, it is not "essential" to the invention of claims 1 or 10 that anything be done with the feedback parameter.

There is nothing in the application that suggests that the additional steps proposed in the Office Action's § 112 rejection are "essential" to implementations of the invention of claims 1 and 10. To the contrary, it is clear from the application that, on most measurements or phase retrieval operations according to the inventions of claims 1 and 10, nothing needs to be done with the feedback parameter because the methods will converge without errors or stagnation. Thus, practice of the inventions of claims 1 and 10 may generate but not use the feedback parameter.

It appears that the Office Action views the use of the word "feedback" in the claims and application to imply a control system. That is not intended nor does the application indicate that a control system is required to implement its teachings. Rather, the various implementations described in the application make it clear that,

while a control system implementation is possible, it is by no means the only way to implement aspects of the application's teachings. Similarly, while claims 1 and 10 can be implemented to normally perform a function in response to the feedback parameter, that is by no means required.

The Office Action also rejects claim 13 and its dependent claims, despite the explicit recitation that the feedback parameter is used to perform a control operation. The application describes various control operations that might be implemented using the feedback parameter. Applicant submits that there are no missing "essential steps" in the definition of the claim 13 invention. Rather, claim 13 corresponds to a number of different control operations, various examples of which are set out in the application.

Applicant notes that some of the control operations within the scope of claim 13 are specifically called out in claim 13's dependent claims. Applicant submits that the Office Action's § 112 rejection is wholly misplaced with respect to claims 14-21.

Applicant respectfully requests reconsideration and withdrawal of the indefiniteness rejection.

The § 103 Rejections:

The Office Action rejects claims 1-5, 8-11, 13-14, 16-17, 19 and 21 over an article by Kane, et al., "Real-time Inversion of Polarization Gate Frequency-Resolved Optical Gating Spectrograms, Applied Optics, Vol. 42, No. 6, 1140-44 (Feb.

2003) taken in view of U.S. Patent No. 6,570,704 to Palese. The remaining claims are rejected over the Kane article taken in view of the Palese patent and further taken in view of one or more additional references. Applicant submits that, if the teachings of the Kane article were combined with the teachings of the Palese patent, the result of the combination would not be the methods defined by any of the pending claims.

Specifically, the Palese patent teaches using the *output* from a FROG retrieval to provide feedback for phase and wavelength locking of the multiple sources of a laser array. See Palese patent at col. 6, lines 4-14. FROG retrieval itself provides the feedback in the system – there is no process that provides feedback about the quality of the FROG retrieval. If the FROG retrieval has an error or stagnation, neither the Palese patent nor the Kane article would detect such an error or stagnation. The Palese patent does not teach developing feedback that characterizes the quality of the FROG retrieval.

The Palese patent does not suggest modifying the FROG retrieval processes of the Kane article. Nothing in the Palese patent could be used in improving the general FROG retrieval process. For example, the FROG retrieval processes of the Kane article would not benefit from the phase or wavelength locking suggested by the Palese patent.

To be clear, the teachings of the Kane article can and would be readily implemented in the system described by the Palese patent, but that resulting system would not generate the feedback parameter recited in each of the independent claims of the present application. The Palese patent's system generates feedback about wavelengths and phase using FROG to determine the phase and wavelengths of an optical system used to recompress optical pulses that is external to and independent of the FROG device. Neither that sort of feedback nor optical system is used in the FROG retrieval process. If the teachings of the Kane article and the Palese article were combined, the combined system would provide feedback about wavelength and phase locking and would not provide any feedback about the quality of the FROG retrieval process.

The system resulting from modifying the Palese patent in view of the Kane article would never generate a "feedback parameter providing information characterizing the real time phase retrieval" obtained by "processing the measured FROG trace" as required by claim 1 and its dependent claims. The other references do not address the deficiencies of the Office Action's proposed combination. Consequently, claim 1 and claims 2-9 distinguish over the art of record and are in condition for allowance.

Claim 10 similarly distinguishes over the cited references by reciting "generating a feedback parameter providing information characterizing the real

time phase retrieval" obtained by "processing the measured FROG trace data set." The combined teachings of the Kane article and the Palese patent would not generate a feedback parameter characterizing the real time phase retrieval obtained by FROG processing. Thus, claims 10, 11 and 12 distinguish over the art of record and are in condition for allowance.

Claim 13 distinguishes over the art of record by reciting "generating in real time a feedback parameter providing information characterizing the real time phase retrieval" obtained by "processing the measured FROG trace data set." Claim 13 and its dependent claims 14-21 distinguish over the Kane article taken in view of the Palese patent and are in condition for allowance.

Additional Comments:

Applicant wishes to correct certain erroneous comments about the Kane article in the discussion of the dependent claims. The FROG trace error has never been used on real-time FROG systems for real-time monitoring the retrieval because the PCGP algorithm does not use the FROG trace error or perform any minimization. The FROG trace error described in the Kane article was calculated on saved data obtained by a real-time FROG device.

With respect to claims 2, 3, 16 and 17, none of the referenced trace errors or display of trace errors is derived in real time in the Kane article. Figure 3 of the Kane article does not disclose a display of the measured and retrieved FROG traces.

It discloses a raw video display of the output from the FROG device, which is a display of the measured FROG trace (shown as an image and available as a 3-D plot), and it discloses a display of the retrieved pulse. The retrieved pulse is not the same as the retrieved FROG trace. The retrieved pulse is displayed on an X-Y plot while the retrieved FROG trace is calculated from the retrieved pulse and is displayed as an image or a 3-D plot. The retrieved FROG trace is a spectrogram of the retrieved pulse. Comparing the measured FROG trace with the retrieved FROG trace can be used to determine the fidelity of the FROG retrieval, which is even more effective than the real-time display of the FROG trace error.

With respect to the Office Action's comments about claim 4, claim 4 does not relate to a feedback loop. The feedback loop of the Palese patent does not relate to the Kane article's FROG phase retrieval process. Using the previous result as a starting point for a subsequent retrieval is not inherent for FROG retrievals. The FROG retrieval may work best when a pulse with random phase is used as the initial guess. Indeed, using smooth phase for a starting point can actually slow down the retrieval.

With respect to claims 6, 12 and 20, applicant disagrees with the Office Action's assumptions with respect to gamma correction. Gamma correction is common in video systems. It is not commonly used in scientific applications, however. The reason for gamma correction in some of the application's real-time

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FROG inversions is not obvious. Because FROG retrievals use the square root of image data, any noise present in the FROG trace is effectively amplified, sometimes severely, which can cause problems with the FROG retrieval. Thus, turning the gamma correction on can help to suppress noise in the FROG retrievals.

Claim 14 teaches the use of a control operation to restart the phase retrieval process and does not discuss the use of a previous result as a starting point for a subsequent retrieval. Applicant consequently submits that the Office Action's analysis of claim 14 is incorrect.

Respectfully submitted,

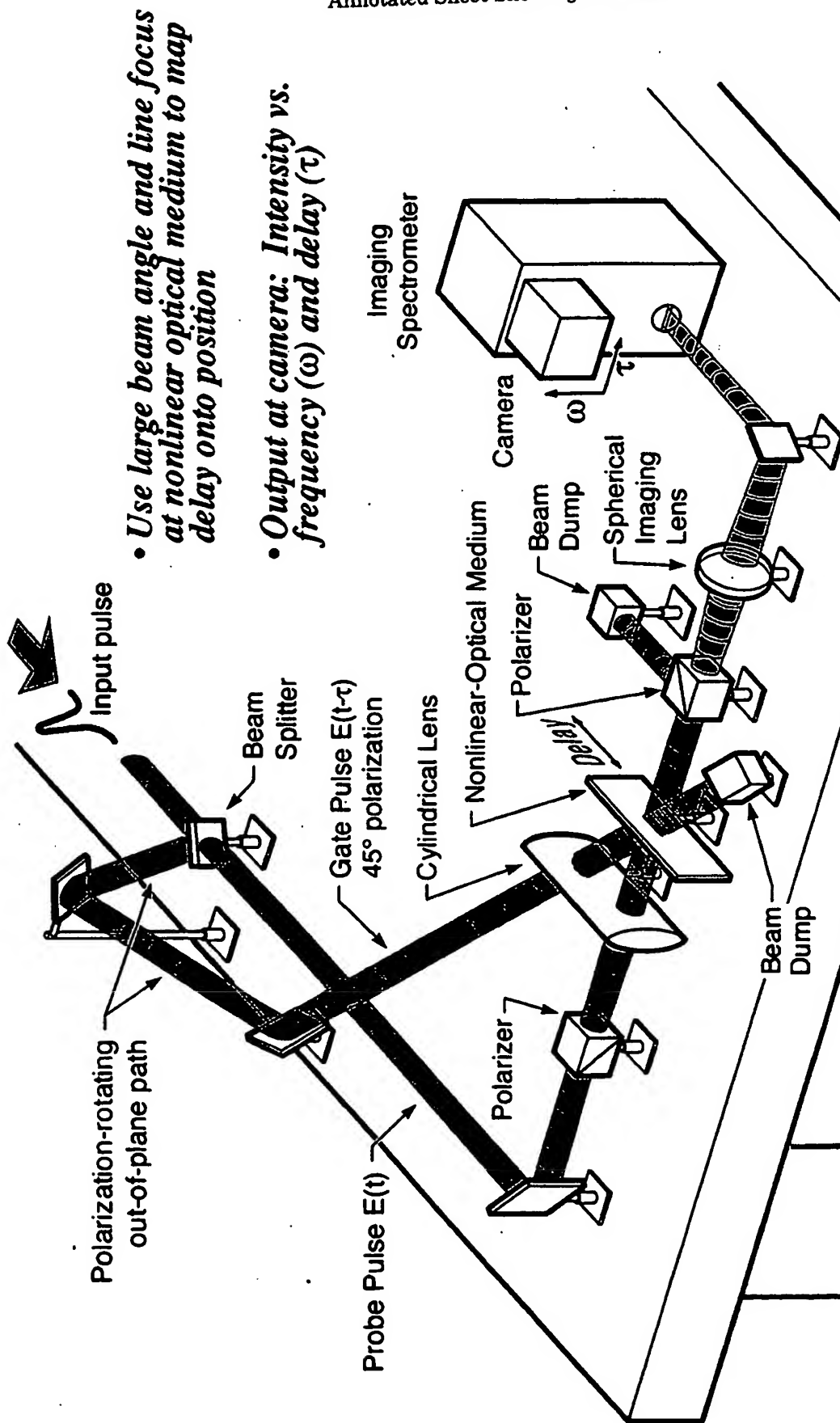
Date: 4/7/2006

By: Daniel J. Kane
Daniel J. Kane

174 Galisteo Lane
Sante Fe, NM 87505

Single-shot Polarization-Gate FROG

Appl. No. 10/808,010
Reply to Office Action of 02/21/06
Annotated Sheet Showing Changes



• Use large beam angle and line focus at nonlinear optical medium to map delay onto position

• Output at camera: Intensity vs. frequency (ω) and delay (τ)

PRIOR ART

FIG. 1

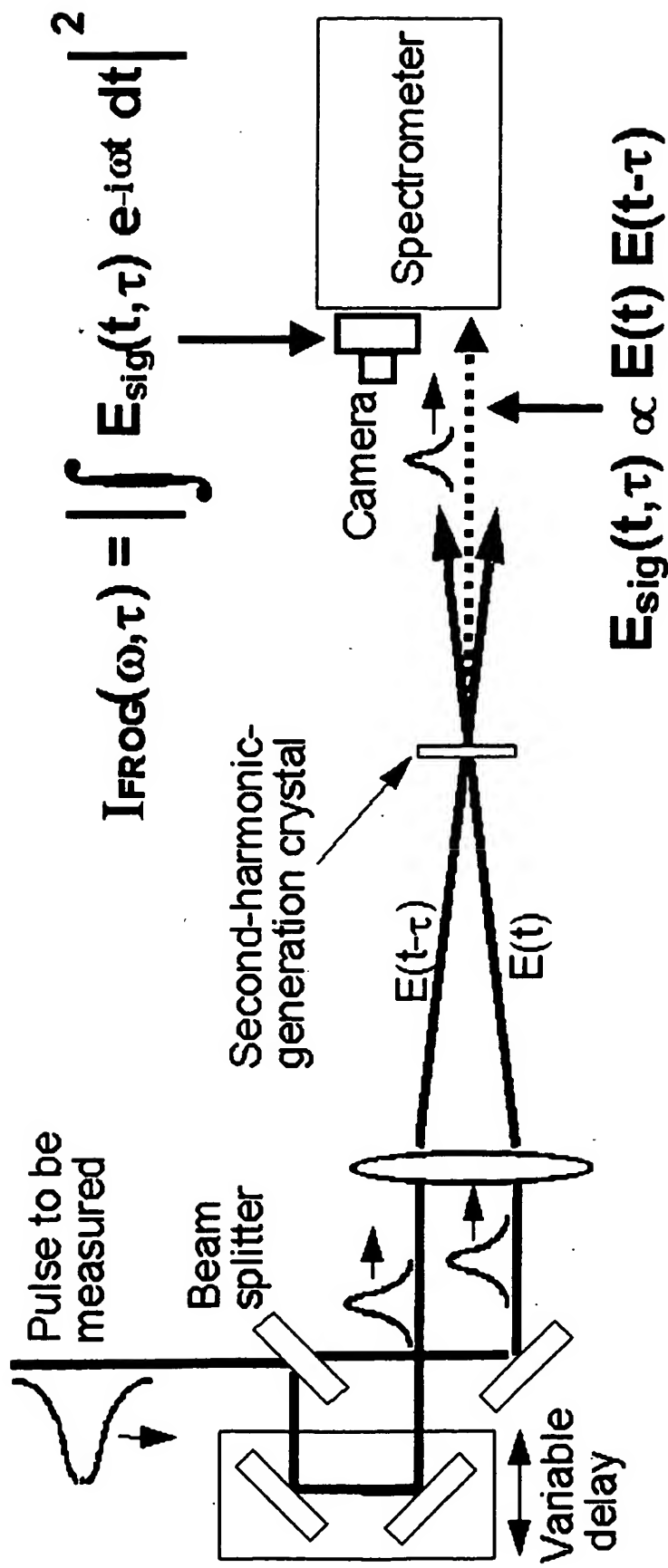


FIG. 2

PRIOR ART

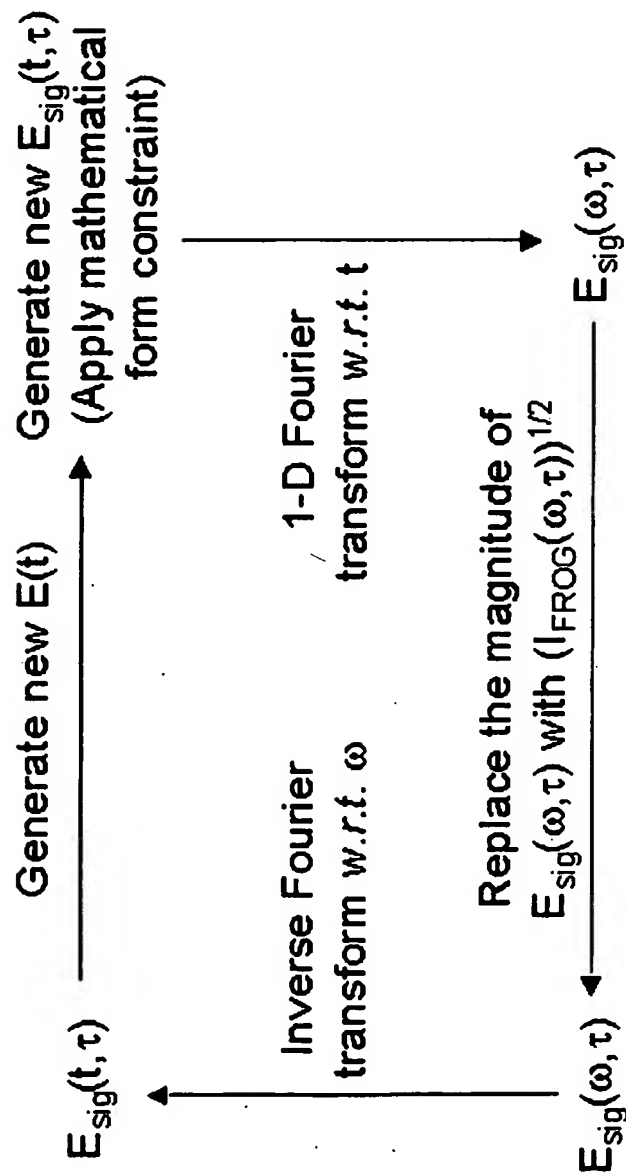


FIG. 3

PRIOR ART

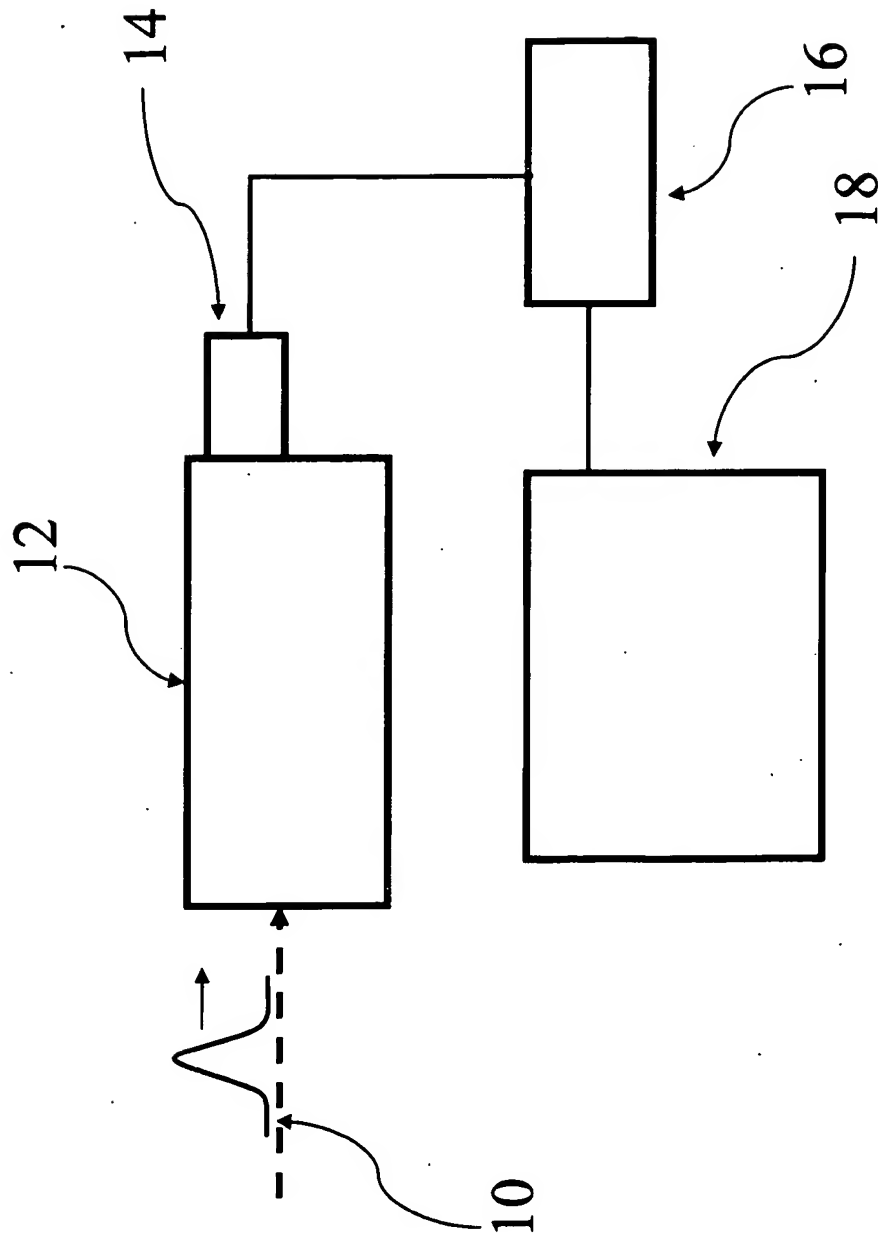


FIG. 4

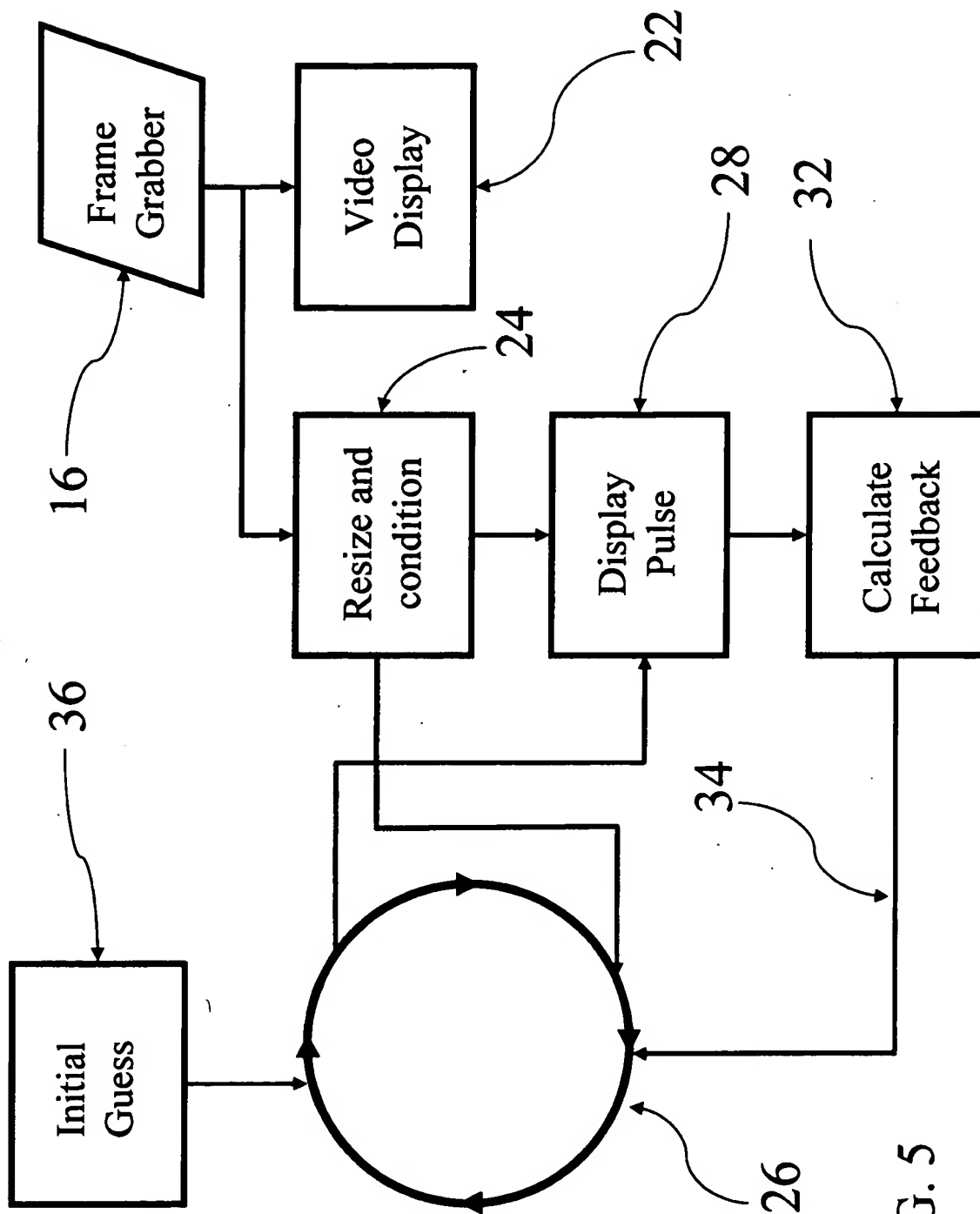


FIG. 5

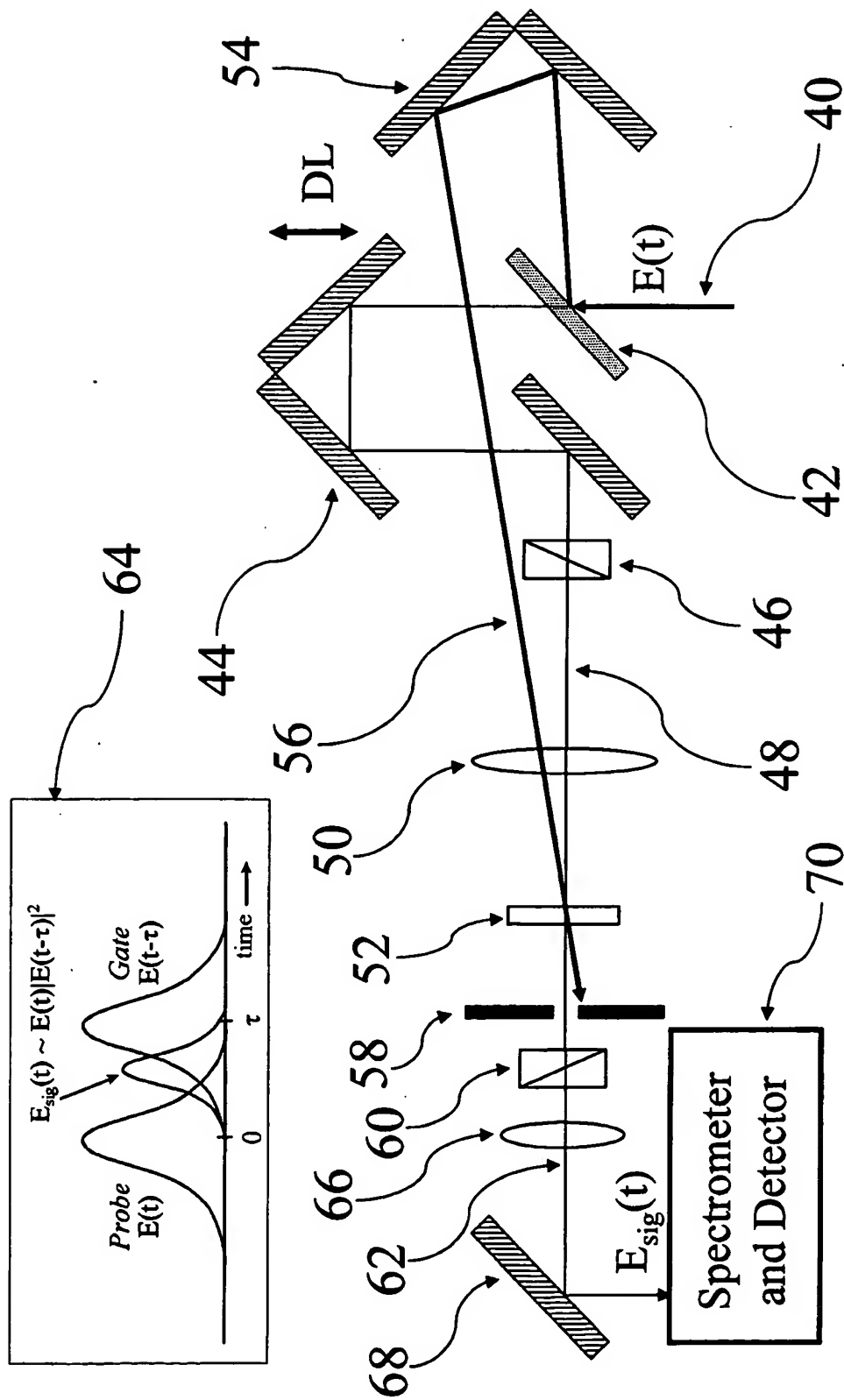


FIG. 6

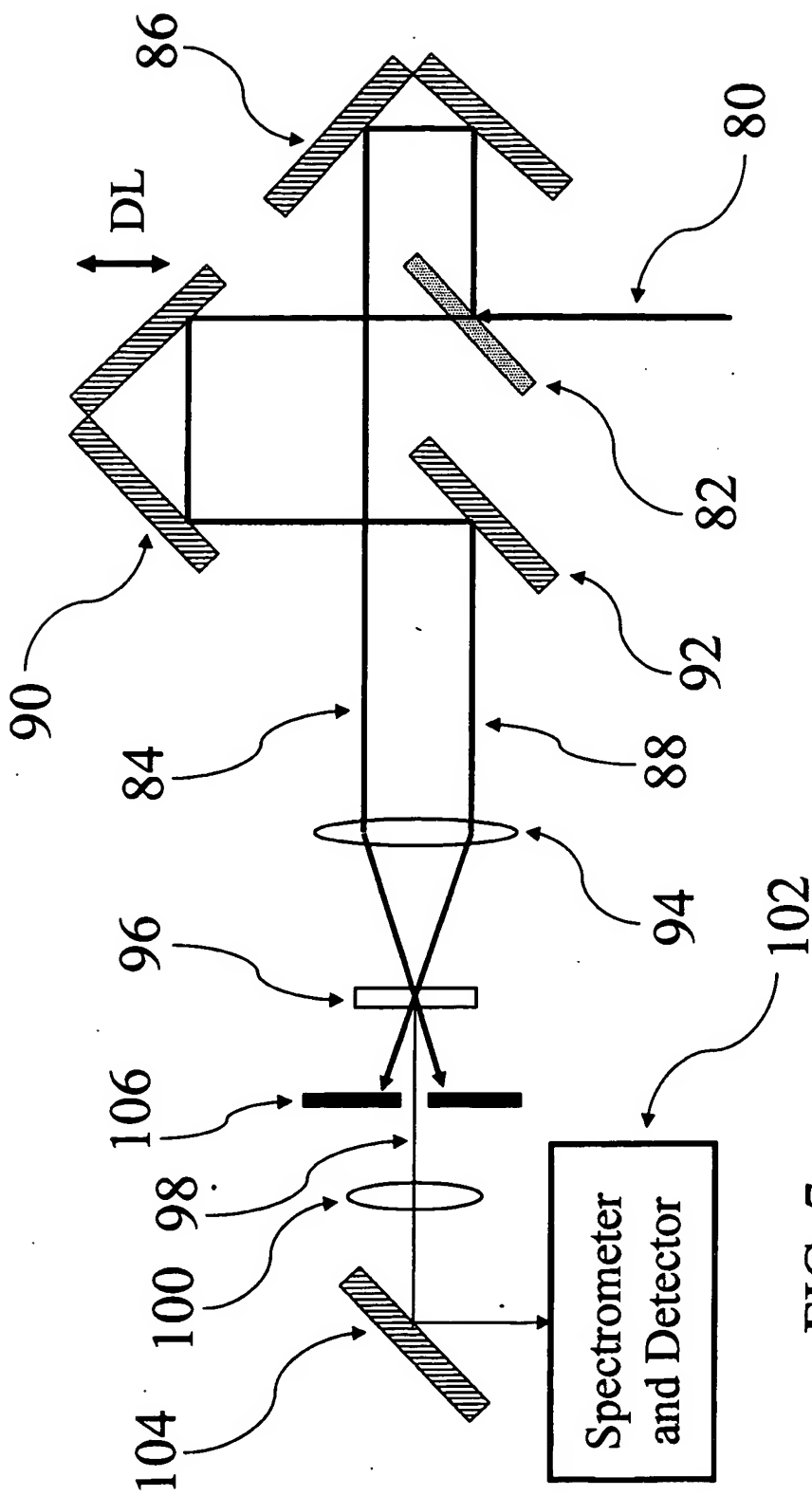


FIG. 7